DETAILED ACTION

Priority

1. Receipt is acknowledged of papers submitted under 35 U.S.C. 119(a)-(d), which papers have been placed of record in the file.

Information Disclosure Statement

2. The information disclosure statement (IDS) submitted on 19 September 2006 is being considered by the examiner.

Specification

3. The disclosure is objected to because of the following informalities: please amend each instance of "aluminium" to read "aluminum"; the word "nanoncrystal" on Page 23, Line 20 should read "nanocrystal"; the word "chloform" on Page 30, Line 2 should read "chloroform"; the word "slenide" on Page 33, Line 9 should read "selenide".

Appropriate correction is required.

Claim Rejections - 35 USC § 102

4. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
>
> (b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

5. Claims 1-18, 22-27 and 29 are rejected under 35 U.S.C. 102(b) as being anticipated by Sakurai (`879) in view of Weinberger (`781; provided as evidence of what Nesa glass comprises).

a. Regarding claim 1 and 27, Sakurai teaches an organic electronic device comprising at least two electrodes (the tin oxide of the Nesa glass of Element 1 and Element 4; see Weinberg Col. 2, Lines 65-71 who evidences that Nesa glass is a commercial name for tin oxide electrode coated glass) and a semiconducting layer comprising a mixture of at least one hole-transporting semiconducting layer (Element 5 or 14, for example; see Col. 10, Lines 6-7 with examples of p-type organic semiconductors) and at least one electron-transporting semiconducting layer (Element 3; see Col. 4, Lines 9-10 and Lines 58-65). The hole-transporting semiconducting layer comprises semiconducting polymer brushes (see Elements 4 and 14 in Fig. 1 and 6, for example, showing highly interpenetrated networks of brushes from polymers, such as polypyrrole) attached to a surface of one of the electrodes (Element 2 is attached to the brushes) and in contact with the electron-transporting semiconducting layer (see Figs. 1 and 6, for example). Furthermore, the term "polymer brushes" does not distinguish the limitation from the prior art, since such a description is extremely broad and reads a wide variety of configurations for the layer, including the branched dendritic structures of Sakurai.

b. Regarding claim 2, Sakurai teaches that the semiconducting polymer brushes are intercalated with the electron-transporting semiconducting layer (see Figs. 1 and 6, for example). The language, term, or phrase "wherein contact between said semiconducting polymer brushes attached the electrode and said at least one other semiconducting material is achieved by", is directed towards the process of making a contact between the semiconducting layers. It is well settled that "product by process" limitations in claims drawn to structure are directed to the product, per se, no matter how actually made. *In re Hirao*, 190 USPQ 15 at 17 (footnote 3). See also, *In re Brown*, 173 USPQ 685; *In re Luck*, 177 USPQ 523; *In re Fessmann*, 180 USPQ 324; *In re Avery*, 186 USPQ 161; *In re Wethheim*, 191 USPQ 90 (209 USPQ 554 does not deal with this issue); *In re Marosi et al.*, 218 USPQ 289; and particularly *In re Thorpe*, 227 USPQ 964, all of which make it clear that it is the patentability of the final product per se which must be determined in a "product by process" claim, and not the patentability of the process, and that an old or obvious product produced by a new method is not patentable as a product, whether claimed in "product by process" claims or otherwise. The above case law further makes clear that applicant has the burden of showing that the method language necessarily produces a structural difference. As such, the language "wherein contact between said semiconducting polymer brushes attached the electrode and said at least one other semiconducting material is achieved by" only requires the structure of (a), (b) or (c), which does not distinguish the invention from Sakurai, who teaches the structure as claimed in (a) as shown above.

c. Regarding claims 3-5, Sakurai teaches that the devices are photovoltaic devices or electroluminescent devices, for example (see Col. 10, Lines 11-15). The Examiner notes that a recitation of the intended use of the claimed invention must result in a structural difference between the claimed invention and the prior art in order to patentably distinguish the claimed invention from the prior art. If the prior art structure is capable of performing the intended use, then it meets the claim. See, e.g., *In re Pearson*, 181 USPQ 641 (CCPA); *In re Minks*, 169 USPQ 120 (Bd Appeals); *In re Casey*, 152 USPQ 235 (CCPA 1967); *In re Otto*, 136 USPQ 458, 459 (CCPA 1963). See MPEP § 2114.

d. Regarding claims 6-7, Sakurai teaches that the average length of the polymer brushes can be, for example, 100 nm (see Col. 10, Line 53, at least).

e. Regarding claims 8-12, 16-17 and 23, Sakurai teaches that the semiconducting polymer brushes comprise a polymer unit of formula (XIV), since Sakurai teaches polyphenylene (Col. 10, Line 7) or a polyphenylenevinylene (PPV) material (Col. 24, Line 44, at least) as a single species homopolymer.

f. Regarding claims 13-14 and 18, Sakurai teaches that the at least one other semiconductor material comprises a semiconducting small organic molecule material (see Col. 10, Lines 53-65), of perylene or a transition metal transition complex such as Mg phthalocyanine.

g. Regarding claim 15, Sakurai teaches that the semiconducting material comprises a polymer unit of formula (XIV), since Sakurai teaches polyphenylene (Col. 10, Line 7).

h. Regarding claim 22, the language, term, or phrase "wherein said electrode is coated with a hole-transport layer or an electron transport layer before said polymer brushes are attached thereto", is directed towards the process of making the polymer brushes. It is well settled that "product by process" limitations in claims drawn to structure are directed to the product, per se, no matter how actually made. *In re Hirao*, 190 USPQ 15 at 17 (footnote 3). See also, *In re Brown*, 173 USPQ 685; *In re Luck*, 177 USPQ 523; *In re Fessmann*, 180 USPQ 324; *In re Avery*, 186 USPQ 161; *In re Wethheim*, 191 USPQ 90 (209 USPQ 554 does not deal with this issue); *In re Marosi et al.*, 218 USPQ 289; and particularly *In re Thorpe*, 227 USPQ 964, all of which make it clear that it is the patentability of the final product per se which must be determined in a "product by process" claim, and not the patentability of the process, and that an old or obvious product produced by a new method is not patentable as a product, whether claimed in "product by process" claims or otherwise. The above case law further makes clear that applicant has the burden of showing that the method language necessarily produces a structural difference. As such, the language "wherein said electrode is coated with a hole-transport layer or an electron transport layer before said polymer brushes are attached thereto" only requires the structure of the polymer brushes. Furthermore, Sakurai teaches this method of forming the polymer brushes by forming the hole-transport layer (see Col. 8, Lines 20-23).

i. Regarding claims 24, 26 and 29, Sakurai teaches a process for manufacturing an organic electronic device comprising coating a substrate with a material to form a first electrode (the tin oxide of the Nesa glass of Element 1; see Weinberg Col. 2, Lines 65-71 who evidences that Nesa glass is a commercial name for tin oxide electrode coated glass). The first electrode is brought into contact with a solution of a monomer under conditions suitable for the growth of polymer brushes comprising the monomer from the surface of the electrode (see Col. 9, Lines 45-67 which describes the field polymerization method to produce the polymer brushes) forming a hole transport layer (see Col. 10, Lines 6-7 with examples of p-type organic semiconductors). The product in then treated in such a way as to produce a product in which the polymer brushes are in contact with at least one further semiconducting material (of Element 3, for example). The product is then coated with to form a further electrode (of Element 4). Regarding the optional step of (b) in claim 24 and the optional steps of (b), (c), and (e) in claim 29, the examiner notes that language that suggests or makes optional but does not require steps to be performed or does not limit a claim to a particular structure does not limit the scope of a claim or claim limitation. See MPEP § 2106 II C. As such, the step is not required for anticipation of the claim.

j. Regarding claim 25, as already noted, language that suggests or makes optional but does not require steps to be performed or does not limit a claim to a particular structure does not limit the scope of a claim or claim limitation. See MPEP § 2106 II C.

As such, since the self-assembled monolayer is optional, not required, then the material from which it is made are also not required.

Claim Rejections - 35 USC § 103

6. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

7. Claims 19-21 are rejected under 35 U.S.C. 103(a) as being unpatentable over Sakurai (`879) in view of Weinberger (`781; provided as evidence of what Nesa glass comprises) in view of Greenham (AIP Conference 1997; cited on IDS submitted 19 September 2006).

Sakurai teaches the device of claim 1 for use as a photovoltaic, but does not teach using a semiconducting nanocrystalline CdSe as the other semiconducting material.

However, Greenham teaches using semiconducting nanocrystalline CdSe as the electron transport layer opposite a PPV-derivative hole transport layer (see Page 297, Lines 3-10 and 17-23). It would have been obvious to one of ordinary skill in the art at the time the invention was made to use semiconducting nanocrystalline CdSe as taught by Greenham as the other semiconducting material of Sakurai. One would have been motivated to do so since Greenham teaches that these semiconducting CdSe nanocrystals are suitable electron acceptors that have a optical bandgap in the visible region and quench photoluminescence from the polymer, thereby resulting in improved photovoltaic efficiency of the device (see Greeham Page 297, Lines 3-10

and 17-23; Page 299, Lines 14-21_297, Lines 3-10 and 17-21). It has been held that the selection of a known material based on its suitability for its intended use supported a prima facie obviousness determination in *Sinclair & Carroll Co. v. Interchemical Corp.*, 325 U.S. 327, 65 USPQ 297 (1945). See also *In re Leshin*, 227 F.2d 197, 125 USPQ 416 (CCPA 1960). MPEP § 2144.07.

8. Claim 28 is rejected under 35 U.S.C. 103(a) as being unpatentable over Sakurai (`879) in view of Weinberger (`781; provided as evidence of what Nesa glass comprises) in view of Iechi (`153).

Sakurai teaches the device of claim 27 for use as an electroluminescent device, but does not teach that the device is a field effect transistor.

However, Iechi teaches forming an electroluminescent field effect transistor (see Fig. 1; Col. 7, Lines 40-43), by forming a gate electrode (Element 4) in between hole transport and electron transport layers of an electroluminescent device (see Elements 3a, 3b, 13a, 13b). It would have been obvious to one of ordinary skill in the art at the time the invention was made to form the electroluminescent device of Sakurai as a field effect transistor as taught by Iechi. One would have been motivated to do so since Iechi teaches the advantages of this configuration are balanced charge injection (see Col. 7, Lines 40-43), controllability of the luminescence of the device with the gate for displays (see Col. 5, Lines 6-7) with low production cost (see Col. 5, Lines 7-8) and high speed (see Col. 5, Lines 4-5).

9. Claim 30 is rejected under 35 U.S.C. 103(a) as being unpatentable over Sakurai (`879) in view of Weinberger (`781; provided as evidence of what Nesa glass comprises) in view of Tokito (J. Phys. D, Appl. Phys., Vol. 29).

Sakurai teaches the process of claim 29 for use as an electroluminescent device, but does not teach coating a layer of electronically insulating material on the first electrode.

However, Tokito teaches forming an electrically insulating material, such metal oxide (see Table 1 for resistivity), on a tin oxide anode (see Fig. 1 and associated text). It would have been obvious to one of ordinary skill in the art at the time the invention was made to form the electrically insulating layer, such as metal oxide, as taught by Tokito on the tin oxide electrode of Sakurai. One would have been motivated to do so since Tokito teaches that the inclusion of forming the electrically insulating metal oxide material on the first electrode results in improved device performance through reduced operating voltages and longer device lifetime (see Conclusions section of Tokito, for example).

10. Claim 31 is rejected under 35 U.S.C. 103(a) as being unpatentable over Sakurai (`879) in view of Weinberger (`781; provided as evidence of what Nesa glass comprises) in view of Huang (Appl. Phys. Lett., Vol. 80).

Sakurai teaches the process of claim 29 for use as an electroluminescent device, but does not teach coating a layer of electronically insulating material on the hole transporting polymer brushes.

However, Huang teaches forming an electrically insulating material on the hole transport layer (and also between the hole transport layer and electron transport layer) of an

electroluminescent device (see Fig. 1 and associated text). It would have been obvious to one of ordinary skill in the art at the time the invention was made to form the electrically insulating layer as taught by Huang on the hole transport layer of Sakurai. One would have been motivated to do so since Huang teaches that the inclusion of forming the electrically insulating material on the hole transport layer (and also between the hole transport layer and electron transport layer) results in improved device performance through enhanced injection (see Huang Page 140, Right Col., Lines 3-6, for example).

11. Claim 32 is rejected under 35 U.S.C. 103(a) as being unpatentable over Sakurai (`879) in view of Weinberger (`781; provided as evidence of what Nesa glass comprises) in view of Kathirgamanathan (WO `323).

Sakurai teaches the device of claim 1 for use as an electroluminescent device, but does not teach using, for example, TMHD as the other semiconducting material.

However, Kathirgamanathan teaches that TMHD is an excellent electroluminescent compound that can be formed on a hole transport layer as an electron transport layer (see Page 4, Lines 4-7 and Page 5, Lines 25-26). It would have been obvious to one of ordinary skill in the art at the time the invention was made to use the TMHD taught by Kathirgamanathan as the other semiconducting material of Sakurai. One would have been motivated to do so since Kathirgamanathan teaches that the TMHD material is suitable as an electron transport layer (Page 5, Lines 25-26) and has strong luminescent properties with stability in air (see Page 4, Lines 4-7). It has been held that the selection of a known material based on its suitability for its intended use supported a prima facie obviousness determination in *Sinclair & Carroll Co. v.*

Interchemical Corp., 325 U.S. 327, 65 USPQ 297 (1945). See also *In re Leshin*, 227 F.2d 197, 125 USPQ 416 (CCPA 1960). MPEP § 2144.07.

Conclusion

12. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure:

Afzali-Aradakani (`327), Yitzchaik (`803), Dai (J. Phys. Chem. B, Vol. 104), Milner (Science, Vol. 251), Jones (Adv. Mater., Vol. 14), Maki-Ontto (Adv. Mater., Vol. 13), Stolka (J. Poly. Sci.: Poly. Chem., Vol. 21), and Deng (Chem. Mater., Vol. 14) each teach methods for forming polymer brush configurations for various devices.

Contact Information

13. Any inquiry concerning this communication or earlier communications from the examiner should be directed to MATTHEW W. SUCH whose telephone number is (571)272-8895. The examiner can normally be reached on Monday - Friday 9AM-5PM EST.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Kiesha Bryant can be reached on (571) 272-1844. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/Matthew W. Such/
Examiner, Art Unit 2891